HD74HC4052/HD74HC4053

Dual 4-channel Analog Multiplexers/Demultiplexers
Triple 2-channel Analog Multiplexers/Demultiplexers

HITACHI

ADE-205-536 (Z)
1st. Edition
Sep. 2000

Description

HD74HC4052: This device connects together the outputs of 4 switches in two sets, thus achieving a pair of 4 channel multiplexers. The binary code placed on the A, and B select lines determine which switch in each 4 channel section is “on”, connecting one of the four inputs in each section to its common output. This enables the implementation of a 4 channel differential multiplexer.

HD74HC4053: This device contains 6 switches whose outputs are connected together in pairs, thus implementing a triple 2 channel multiplexer, or the equivalent of 3 single-pole-double throw configuration. Each of the A, B, or C select lines independently controls one pair of switches, selecting one of the two switches to be “on”.

Features

- High Speed Operation
- Wide Operating Voltage
- Low Quiescent Supply Current

Hitachi semiconductor

Function Table

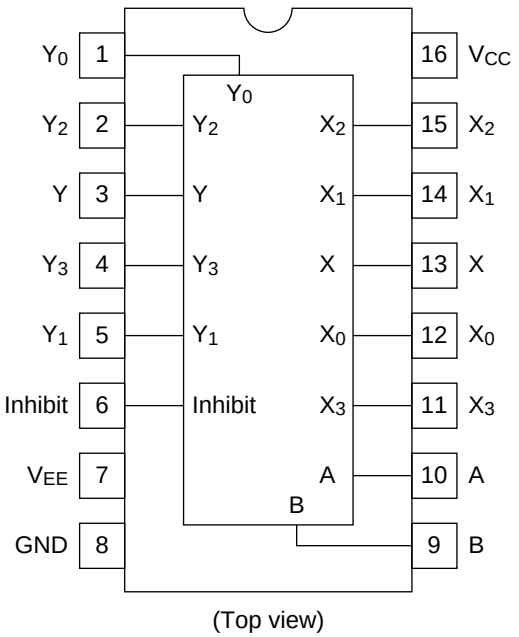
Control Inputs

	Select			ON Switch				
Inhibit	**C*[1]**	**B**	**A**	**HD74HC4052**		**HD74HC4053**		
L	L	L	L	Y_0	X_0	Z_0	Y_0	X_0
L	L	L	H	Y_1	X_1	Z_0	Y_0	X_1
L	L	H	L	Y_2	X_2	Z_0	Y_1	X_0
L	L	H	H	Y_3	X_3	Z_0	Y_1	X_1
L	H	L	L			Z_1	Y_0	X_0
L	H	L	H			Z_1	Y_0	X_1
L	H	H	L			Z_1	Y_1	X_0
L	H	H	H			Z_1	Y_1	X_1
H	X	X	X	—		—		

Note: 1. Not applicable for HD74HC4052
X = Dont't Care

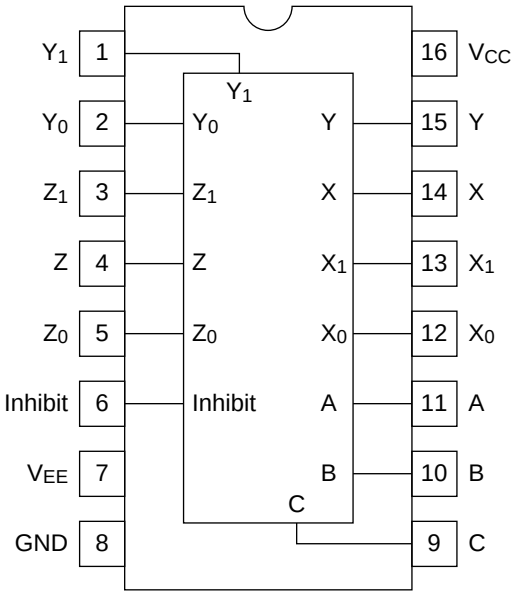
Pin Arrangement

HD74HC4052



(Top view)

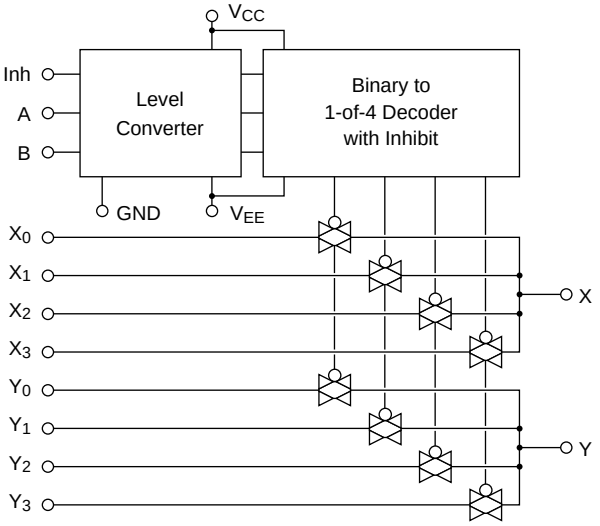
HD74HC4053



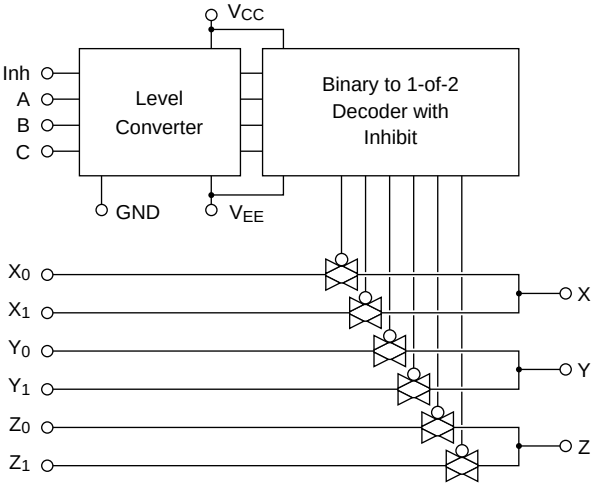
(Top view)

Block Diagram

HD74HC4052



HD74HC4053



Absolute Maximum Ratings

Item		Symbol	Rating	Unit
Supply voltage		V_{CC}	–0.5 to +7.0	V
		$V_{CC} – V_{EE}$	–0.5 to +7.0	V
Control input voltage		V_{IN}	GND – 0.5 to V_{CC} + 0.5	V
Switch I/O voltage		$V_{I/O}$	V_{EE} –0.5 to V_{CC} + 0.5	V
Supply current	(V_{CC})	I_{CC}	+50	mA
	(GND)	I_{GND}	–50	mA
Switch I/O current (per pin)		$I_{I/O}$	±25	mA
Control input diode current		I_{IK}	±20	mA
Switch I/O diode current		I_{IOK}	±20	mA
Power dissipation		P_T	500	mW
Storage temperature range		Tstg	–65 to +150	°C

Recommended Operating Range

Item		Symbol	Min	Typ	Max	Unit
Supply voltage		$V_{CC} – V_{EE}$	2	—	6	V
		GND – V_{EE}	–4	—	0	V
Control input voltage		V_{IN}	0	—	V_{CC}	V
Switch I/O voltage		$V_{I/O}$	V_{EE}	—	V_{CC}	V
Operating temperature		Topr	–40	—	+85	°C
Input rise/fall time	V_{CC} = 2.0 V	t_r, t_f	0	—	1000	ns
	V_{CC} = 4.5 V		0	—	500	ns
	V_{CC} = 6.0 V		0	—	400	ns

DC Characteristics (V_{EE} = GND)

			Ta = 25°C			Ta = –40 to +85°C			
Item	**Symbol**	**V_{CC} (V)**	**Min**	**Typ**	**Max**	**Min**	**Max**	**Unit**	**Test Conditions**
Control input voltage	V_{IH}	2.0	1.5	—	—	1.5	—	V	
		4.5	3.15	—	—	3.15	—		
		6.0	4.2	—	—	4.2	—		
	V_{IL}	2.0	—	—	0.5	—	0.5	V	
		4.5	—	—	1.35	—	1.35		
		6.0	—	—	1.8	—	1.8		
ON resistance	R_{ON}	2.0	—	2000	5000	—	6250	Ω	$V_{INH} = V_{IL}$
		4.5	—	120	180	—	225		$V_{I/O} = V_{CC}$ to V_{EE}
		6.0	—	100	170	—	210		$I_{I/O} \leq 2$ mA
		2.0	—	200	800	—	1000	Ω	$V_{INH} = V_{IL}$
		4.5	—	80	150	—	190		$V_{I/O} = V_{CC}$ to V_{EE}
		6.0	—	70	140	—	175		$V_{I/O} \leq 2$ mA
ΔON resistance between any two channels	ΔR_{ON}	2.0	—	50	—	—	—	Ω	$V_{INH} = V_{IL}$
		4.5	—	13	40	—	50		$V_{I/O} = V_{CC}$ to V_{EE}
		6.0	—	10	20	—	25		$I_{I/O} \leq 2$ mA
OFF channel leakage current (switch off)	$I_{S (OFF)}$	6.0	—	—	±0.1	—	±1.0	µA	$V_{INH} = V_{IL}$
OFF channel leakage current (switch on)	$I_{S (ON)}$	6.0	—	—	±0.1	—	±1.0	µA	$V_{INH} = V_{IL}$
Control input current	Iin	6.0	—	—	±0.1	—	±1.0	µA	Vin = V_{CC} or GND
Quiescent supply current	I_{CC}	6.0	—	—	4.0	—	40	µA	Vin = V_{CC} or GND

AC Characteristics (C_L = 50 pF, Input t_r = t_f = 6 ns, V_{EE} = GND)

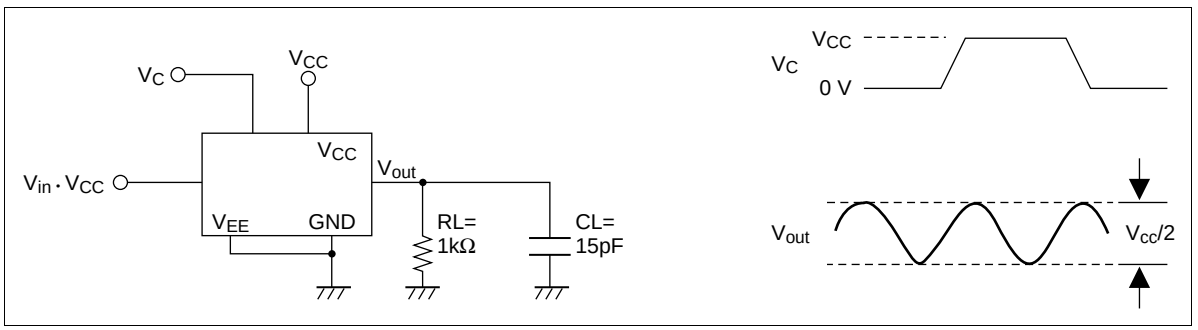
			Ta = 25°C			Ta = –40 to +85°C			
Item	**Symbol**	**V_{CC} (V)**	**Min**	**Typ**	**Max**	**Min**	**Max**	**Unit**	**Test Conditions**
Propagation delay time	t_{PLH}	2.0	—	25	60	—	75	ns	R_L = 10 kΩ Switch input to switch output
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
	t_{PHL}	2.0	—	25	60	—	75	ns	
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
Propagation delay time	t_{PLH}	2.0	—	50	153	—	191	ns	R_L = 10 kΩ Control input to switch output
		4.5	—	16	30	—	38		
		6.0	—	14	26	—	33		
	t_{PHL}	2.0	—	50	153	—	191	ns	
		4.5	—	16	30	—	38		
		6.0	—	14	26	—	33		
Output enable time	t_{ZH}	2.0	—	50	153	—	191	ns	R_L = 1 kΩ
		4.5	—	14	30	—	38		
		6.0	—	12	26	—	33		
	t_{ZL}	2.0	—	50	153	—	191	ns	
		4.5	—	14	30	—	38		
		6.0	—	12	26	—	33		
Output disable time	t_{HZ}	2.0	—	40	153	—	191	ns	R_L = 1 kΩ
		4.5	—	17	30	—	38		
		6.0	—	14	26	—	33		
	t_{LZ}	2.0	—	40	153	—	191	ns	
		4.5	—	17	30	—	38		
		6.0	—	14	26	—	33		
Control input capacitance	Cin	—	—	5	10	—	10	pF	
Switch input capacitance	Cin	5.0	—	5	—	—	—	pF	
Output capacitance	Cout	5.0	—	12	—	—	—	pF	HD74HC4052
(Common pin)		5.0	—	6	—	—	—		HD74HC4053
Feed through capacitance	Cin–out	5.0	—	0.6	—	—	—	pF	HD74HC4052
		5.0	—	0.5	—	—	—		HD74HC4053

AC Characteristics (C_L = 50 pF, Input $t_r = t_f$ = 6 ns, V_{EE} = GND) (cont)

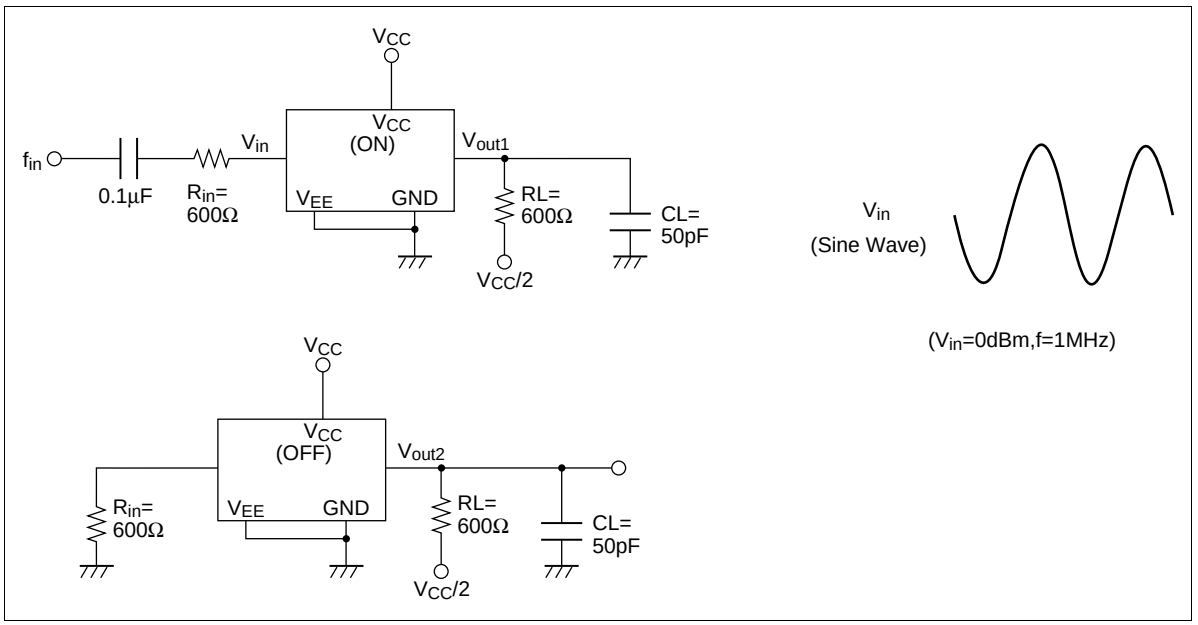
			Ta = 25°C			Ta = –40 to +85°C			
Item	**Symbol**	**V_{cc} (V)**	**Min**	**Typ**	**Max**	**Min**	**Max**	**Unit**	**Test Conditions**
Power dissipation capacitance	C_{PD}	5.0	—	32.0	—	—	—	pF	HD74HC4052
		5.0	—	17.0	—	—	—		HD74HC4053
Sine wave distortion		4.5	—	0.1	—	—	—	%	f_{in} = 1 kHz, Vin = 4 V_{P-P} R_L = 10 kΩ, C_L = 50 pF
Frequency response channel “ON” (Sine wave input)		4.5	—	95	—	—	—	MHz	f_{in} = 1 MHz, 20 $\log_{10}$ V_{OS}/V_{IS} = –3 dB R_L = 50 Ω, C_L = 10 pF
Feed through attenuation		4.5	—	–50	—	—	—	dB	R_L = 600 Ω, C_L = 50 pF, f_{in} = 1 MHz
Cross talk between control input and switch I/O		2.0	—	25	—	—	—	mV	R_L = 600 Ω, C_L = 15 pF, f_{in} = 1 MHz
		4.5	—	50	—	—	—		
		6.0	—	75	—	—	—		
Cross talk between any two switches		4.5	—	–50	—	—	—	dB	R_L = 600 Ω, C_L = 50 pF, f_{in} = 1 MHz
Maximum control frequency		2.0	—	20	—	—	—	MHz	R_L = 1 kΩ, C_L = 15 pF
		4.5	—	30	—	—	—		Vout = 1/2 (V_{CC})
		6.0	—	30	—	—	—		

AC Characteristics Test Circuit

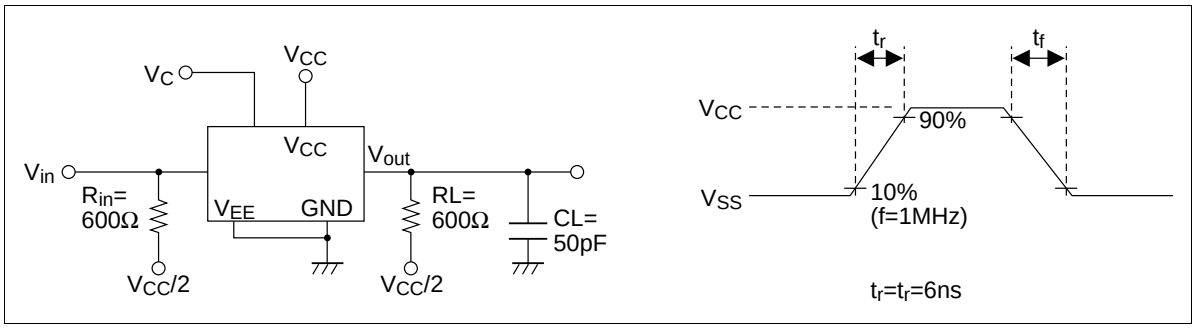
Maximum Control Frequency



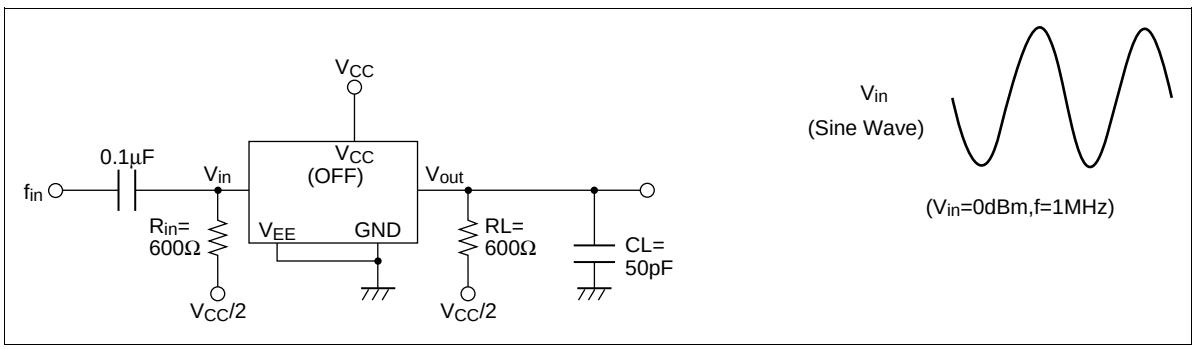
Cross talk (Between Any Two Switches)



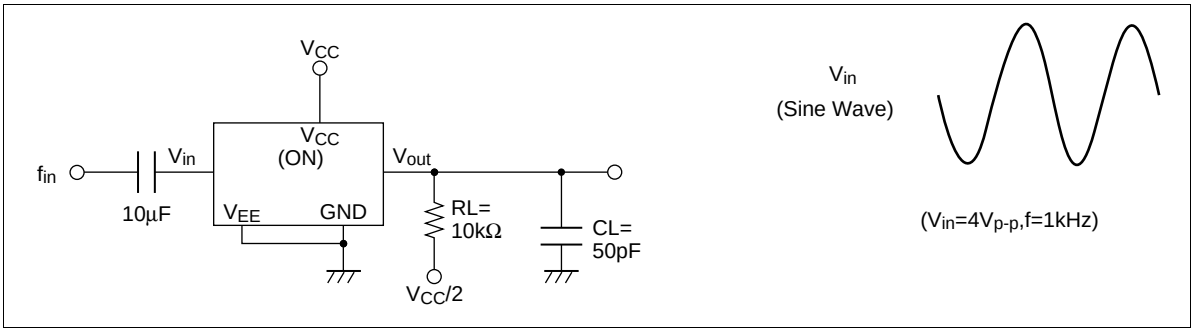
Cross talk (Control Input to Switch Output)



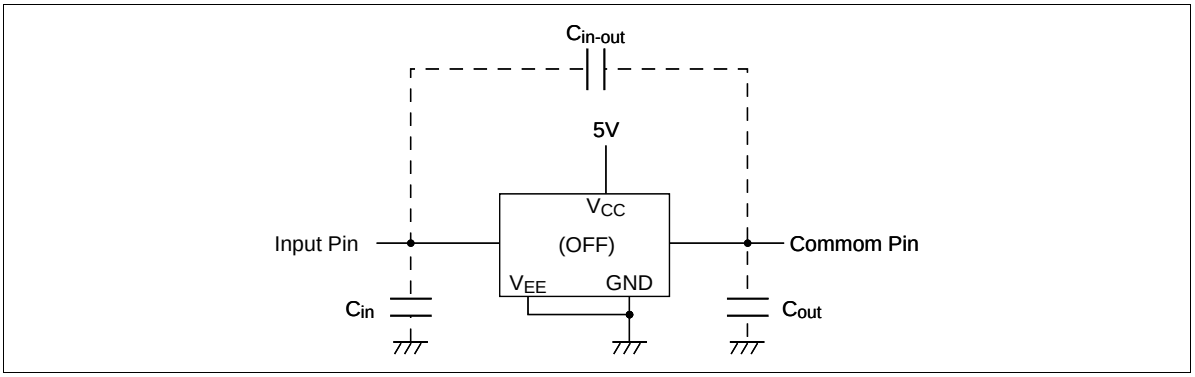
Feed through Attenuation



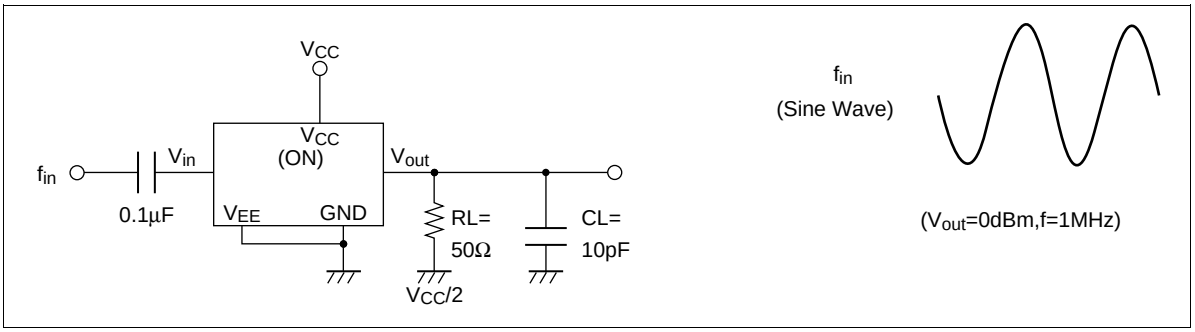
Sine Wave Distortion



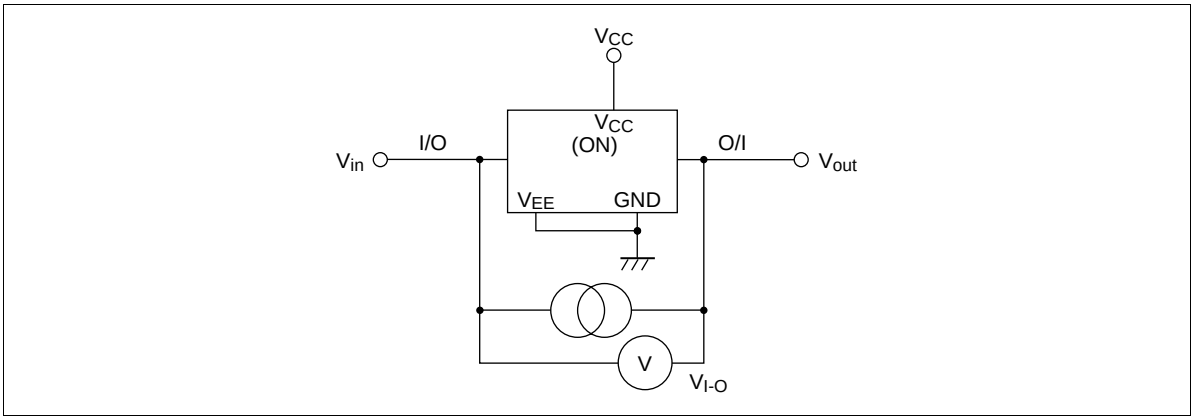
Cin, Cout, Cin–out (Input, Output and Feed through Capacitance)



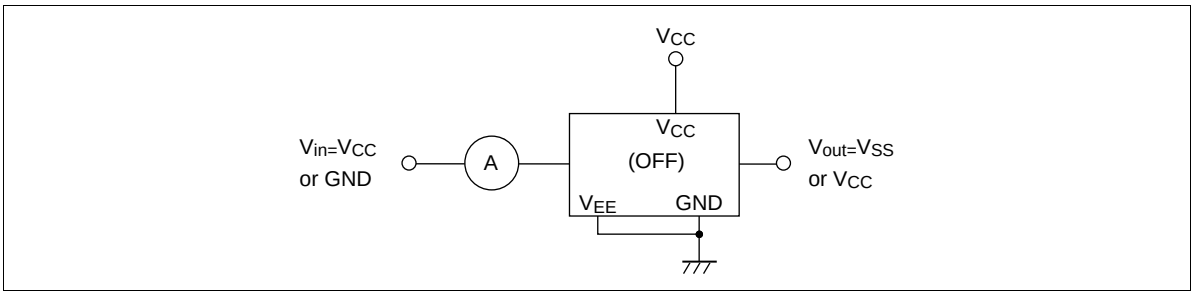
Frequency Response Channel ON



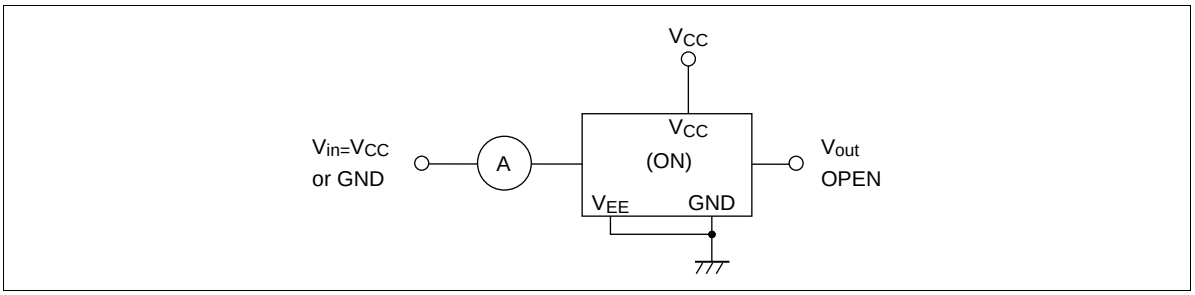
R_{ON}: ON Resistance



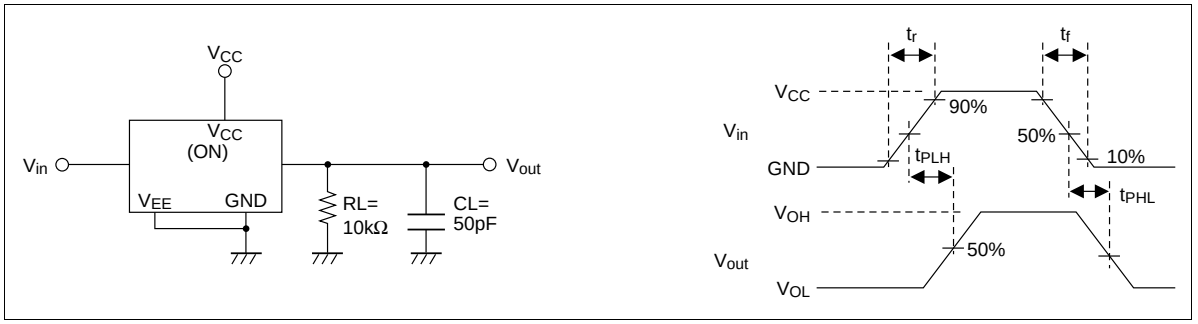
I_S (OFF): OFF Channel Leakage Current (Switch OFF)



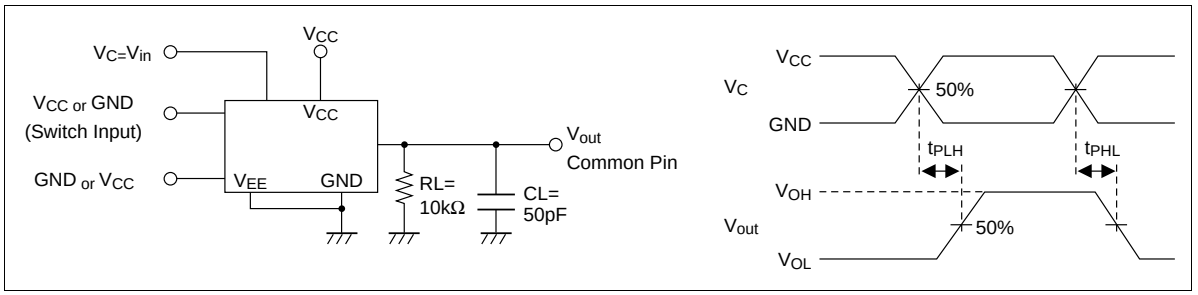
I_S (ON): OFF Channel Leakage Current (Switch ON)



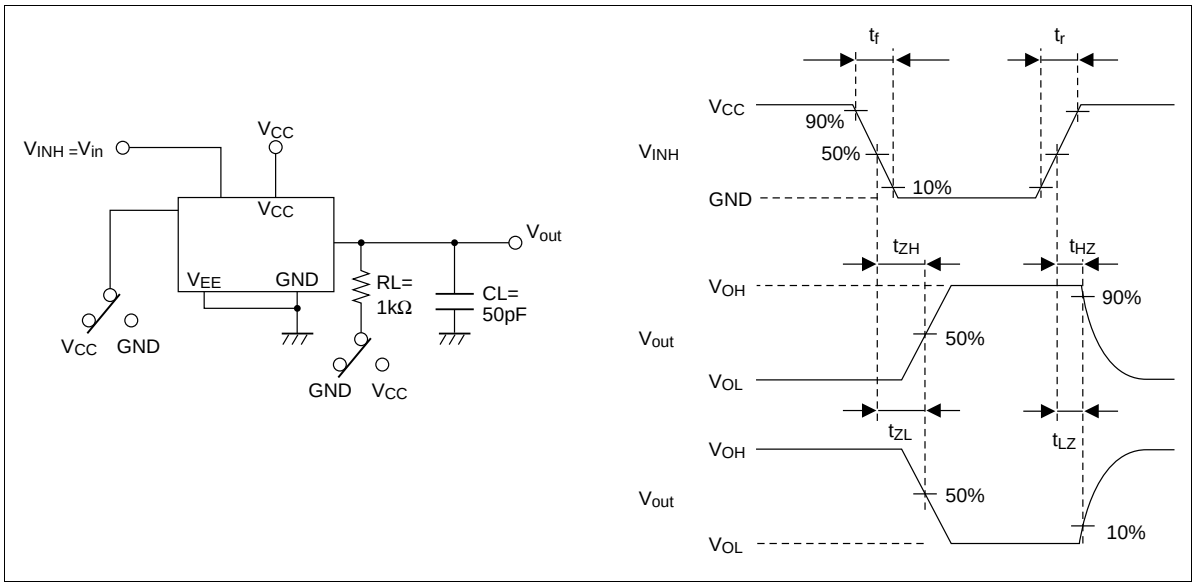
t_{PLH}, t_{PHL}: Propagation Delay Time (Switch Input to Switch Output)



t_{PLH}, t_{PHL}: Propagation Delay Time (Control Input to Switch Output)

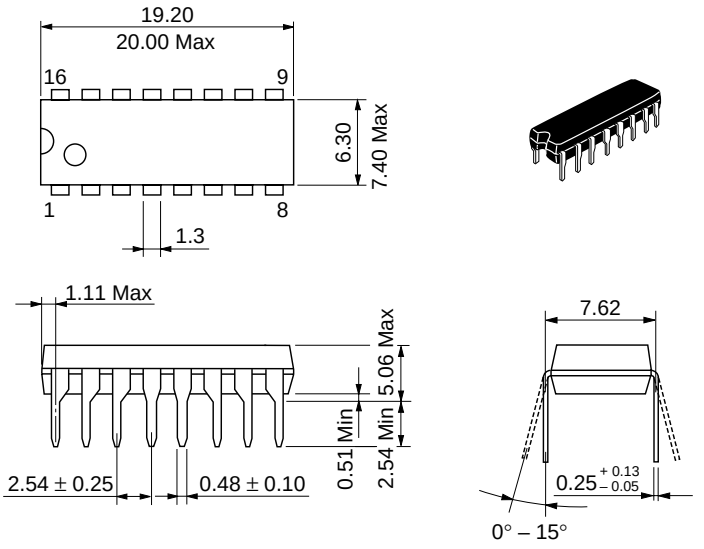


t_{ZH}, t_{ZL}/t_{HZ}, t_{LZ}: Output Enable and Disable Time



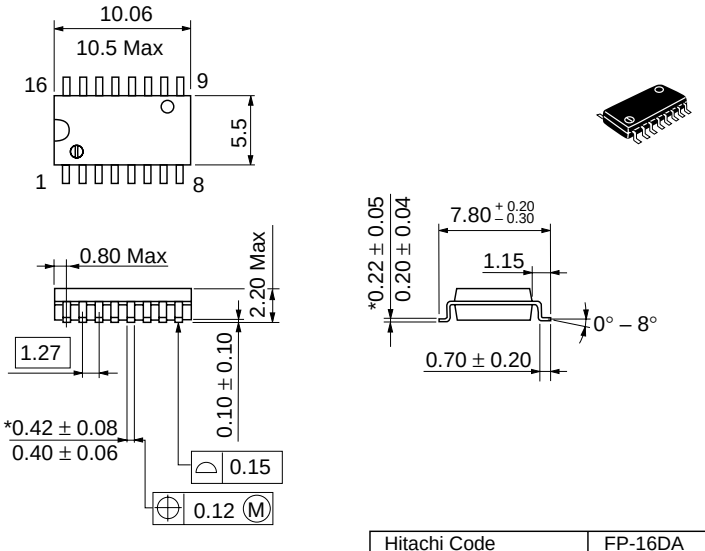
Package Dimensions

Unit: mm



Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	1.07 g

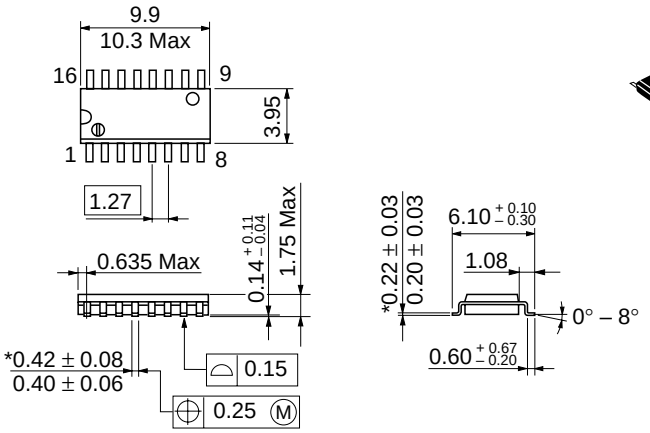
Unit: mm



Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Mass (reference value)	0.24 g

*Dimension including the plating thickness
Base material dimension

Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	0.15 g

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HITACHI

Hitachi, Ltd.
Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL
NorthAmerica : http://semiconductor.hitachi.com/
Europe : http://www.hitachi-eu.com/hel/ecg
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For further information write to:

Hitachi Semiconductor (America) Inc.
179 East Tasman Drive,
San Jose,CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe GmbH
Electronic Components Group
Dornacher Straβe 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 585160

Hitachi Asia Ltd.
Hitachi Tower
16 Collyer Quay #20-00,
Singapore 049318
Tel : <65>-538-6533/538-8577
Fax : <65>-538-6933/538-3877
URL : http://www.hitachi.com.sg

Hitachi Asia Ltd.
(Taipei Branch Office)
4/F, No. 167, Tun Hwa North Road,
Hung-Kuo Building,
Taipei (105), Taiwan
Tel : <886>-(2)-2718-3666
Fax : <886>-(2)-2718-8180
Telex : 23222 HAS-TP
URL : http://www.hitachi.com.tw

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower,
World Finance Centre,
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon,
Hong Kong
Tel : <852>-(2)-735-9218
Fax : <852>-(2)-730-0281
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